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Ms. Magalie R. Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *Ex Parte* Presentation; ET Docket 98-153

Dear Ms. Salas:

The U.S. GPS Industry Council hereby submits for consideration by the Commission in the above-referenced proceeding the attached comments prepared on its behalf by Dr. A. J. Van Dierendonck of AJ Systems. The document provides a point-by-point response to assertions made by Time Domain Corporation on August 2, 2001 in a presentation to the FCC's Office of Engineering and Technology. Dr. Van Dierendonck addresses a number of specific issues relating to the spectral characteristics of UWB and GPS signals, as well as the noise characteristics of UWB signals used in the three GPS susceptibility tests and the implications that can be drawn from the results of these tests.

Should there be any questions concerning this matter, please contact the undersigned counsel.

Respectfully submitted,

/s/ David S. Keir

David S. Keir
Counsel to the U.S. GPS Industry Council

Enclosure

Comments On Time Domain, Inc. Ex Parte Presentation to the FCC on August 2, 2001

On behalf of the U.S. GPS Industry Council
By
Dr. A. J. Van Dierendonck, AJ Systems

Re: *Ex Parte* Notification in ET Docket 98-153

On August 2nd, 2001, Time Domain met with the FCC's Office of Engineering and Technology and filed a letter summarizing the meeting on August 3, 2001.[1]

The purpose of the discussions at that meeting was to review spectral characteristics of UWB and GPS signals, the characteristics of UWB signals used in the three GPS susceptibility tests that have been submitted to the record, and the implications of such testing.

Specifically, Time Domain noted that:

- All three GPS susceptibility tests were performed with UWB signal sources that had spectral lines below some resolution bandwidth;

  Comment: *It is not clear what this statement proves. Certainly there is some bandwidth resolution for which the spectral lines cannot be observed. However, the GPS receiver correlator is essentially a comb-filter that collapses the bandwidth to very narrow spectral lines. Thus, the effect of resolution bandwidth is not material to the problem at hand. From a measurement point-of-view, tests on UWB devices must have high bandwidth resolution.*[2]

- Noise-coded UWB emissions were found to be white-noise-like in those tests;

  Comment: *Unfortunately for UWB, noise does not relay any information. The UWB pulses generated in these noise tests were completely random, and, thus, have no relationship to commercial deployment of UWB devices and networks. UWB pulses that relay information can never be totally random, especially if the data includes protocol, sync bits and a coding length that is not infinite.*[2] *It is also important to note that UWB white-noise-like emissions at Part 15 levels*

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1 Time Domain Corporation Letter to Ms. Magalie Roman Salas, Secretary, Federal Communications Commission, *Re: Ex Parte Notification in ET Docket 98-153* (August 3rd, 2001).

2 See U.S. GPS Industry Council *Ex Parte* Presentation, "*Comments on XtremeSpectrum, Inc. "Emission Mask" Proposal to the FCC*," in response to XtremeSpectrum *Ex Parte* filing "*Comments of XtremeSpectrum, Inc. On Issues of Interference Into Global Positioning System Receivers* (April 25, 2001) and XtremeSpectrum, Inc. *Ex Parte* presentation (May 30, 2001), *ET Docket 98-153* (June 21, 2001).

also exceed GPS Receiver susceptibility levels by 20 to 30 dB, depending upon GPS scenario.

- The Stanford University test did not incorporate either noise coding or data modulation and so was unrepresentative of any useful UWB device, except perhaps a digital device (as would be regulated under the FCC's digital device rules);

  Comment: *However, this can also be said regarding any UWB device with noise-like emissions implied by the previous comment. Time Domain failed to provide a realistic device for those tests. Furthermore, the NTIA tests,[3] and Time Domain sponsored tests at the University of Texas Applied Research Lab (ARL:UT) (using a Time Domain device),[4] did use noise coding. An independent analysis of the ARL: UT conductive test data (used by JHU/APL[5]) was performed by the DoD's Joint Spectrum Center (JSC).[6] This analysis found agreement of the effects of UWB interference between the Time Domain sponsored test data, when properly analyzed, and that of NTIA. Thus, the NTIA simulated UWB waveform accurately emulated the Time Domain UWB waveforms used in the ARL:UT data collection sponsored by Time Domain. Under proper analyses of both sets of test data, one set collected using a Time Domain device, the UWB emissions were shown to interfere with GPS Receivers at levels far below Part 15 by approximately the same level. Thus, the NTIA simulation of UWB devices emulated the Time Domain device very well.*

- The data in the Stanford study showed that at most an additional reduction of 3 dB could be rationalized for spectral features within a 1 MHz bandwidth; Even if one were to accept Stanford's assertion that actual degradation would be worse than the data showed and that about 10 dB should be factored in for spectral features, the Commission's proposal to drop the emissions limit at 2 GHz by 12 dB below the Part 15 class B limit should still provide sufficient protection in any realistic GPS deployment scenario;

  Comment: *This proposal is not consistent with other UWB interference test results (see previous comment). Also, it does not account for the fact that interference levels in the GPS band are already allocated to other interference sources, nor does it account for aggregate effects of multiple UWB emitters. (See further discussions below.) Unfortunately for UWB, intentional emissions*

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[3] See NTIA Special Publication 01-43, *Assessment Of Compatibility Between Ultra-wideband Devices And Selected Federal Systems*, ET Docket 98-153 (January, 2001).

[4] See ARL:UT, Final Report, *Data Collection Campaign for Measuring UWB/GPS Compatibility Effects*, Report No. TL-SG-01-01, February 26, 2001.

[5] See Johns Hopkins University/Applied Physics Laboratory, *Final Report, UWB-GPS Compatibility Analysis Project*, ET Docket No. 98-153 (March 8, 2001) ("*JHU Report*")

[6] See Department of Defense Joint Spectrum Center, *Observations Regarding Test Data Collected at University of Texas Applied Research Laboratory on GPS Receivers Operating in the Presence of UltraWideBand Emissions*, prepared for the Interagency GPS Executive Board (IGEB) Working Group 3, April 2001.

in the GPS band are not supported by ITU regulations.[7] Also, intentionally emitting at 12 dB below the Part 15 limit in the GPS band is not qualified as Out-of-Band Emissions (OOBE). Further, the GPS bands are designated as safety-of-life services by their status as aeronautical radio-navigation satellite service ("ARNS") bands, and thus require special consideration under the international radio regulations.[8]

- Since no study, if analyzed using realistic deployment scenarios and propagation modeling, showed how UWB emissions at Part 15 Class B levels would cause harmful interference to aviation safety-of-life applications, therefore the FCC's proposal to limit UWB emissions in the GPS bands to 12 dB below that limit was more than sufficient to protect GPS; and

  Comment: *This is an untrue statement. The RTCA[8] report shows that UWB emissions in the GPS bands must be limited to 30 dB below Part 15 levels to support aviation safety in all phases of flight. Furthermore, those levels refer to OOBE, not intentional In-Band Emissions (IBE) (see above comment).*

  Unfortunately for UWB, aviation is not the only safety application of GPS. One application that continues to be ignored is that of E911 Emergency Calling Systems.[2] For that application, which is required to operate indoors by the FCC, UWB LAN devices operating in the same area would prevent the FCC-required E911 operation, unless the UWB emission levels were about 40 to 50 dB below Part 15 levels, depending upon UWB signal characteristic.

- We also noted that the emissions limits for UWB energy falling into the GPS bands would likely be cited as a benchmark in other proceedings notwithstanding the fact that the Commission has on three occasions found the -70 dBW/MHz limit sufficient for regulating broadband noise falling within the GPS L1 band.

  Comment: *The –70 dBW/MHz is already allocated by the FCC and ITU (for white-noise-like interference) to Mobile Satellite Services (MSS) out-of-band emissions (OOBE) based on a specific interference scenario for a single emitter. At a 100-foot distance below an aircraft, this allocation already uses up the entire link budget for GPS operations during Category I Precision Approach operations. Thus, this limit is not available to UWB. Per the NTIA report[3], the allocation to UWB is 16 dB less to account for this previous allocation (10 dB)*

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7 See International Radio Regulation S3.15, which provides that *"The use of damped wave emissions is forbidden in all stations."*

8 See International Radio Regulation S4.10, which provides that "*Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies*."

8 See RTCA Special Committee Report "*Preliminary Aviation Approach Segment for Second Interim Report to the Department of Transportation: Ultra-Wideband Technology Radio Frequency Interference Effects to Global Positioning System Receivers and Interference Encounter Scenario Development*," RTCA Paper No. 039-01/PMC-128, February 2, 2001.

and for multiple emitters (6 dB). Thus, the –70 dBW/MHz becomes –86 dBW/MHz for white-noise-like emissions, and up to –96 dBW/MHz for CW-like emissions. Also, remember that the NTIA analysis was performed for Non-Precision Approach (NPA) operations (136 feet separation). For Category I Precision Approach, the emission attenuation is 2.7 dB less than for NPA, and, for Category II/III operations (60 feet separation), attenuation is 5.8 dB less than for NPA. Because of this, RTCA[8] recommends the UWB allocation to be at least 20 dB less than the –70 dBW/MHz, or –90 dBW/MHz for white-noise-like emissions. Another 10 dB is required for CW emissions, or –100 dBW/MHz.

Note, again, that the –70 dBW/MHz is also allocated for OOBE, and not In-Band Emissions (IBE).[9] Further, this specific OOBE limit was "not intended to be applied to any service other than MSS MESs operating in the 1-3 GHz range without further study".[10]

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9 See U.S. GPS Industry Council *Ex Parte* Presentation, "*In-Band Emission (IBE) or Out-of-Band Emissions (OOBE): That is the Question*," ET Docket 98-153 (July 25, 2001).

10 See Rec. ITU-R M.1477, *"Technical and Performance Characteristics of Current and Planned Radionavigation-Satellite Service (Space-To-Earth) and Aeronautical Radionavigation Service Receivers To Be Considered In Interference Studies in the Band 1559-1610 MHz*". NOTE 1 – *This Recommendation is not intended to be used to form the basis for future modifications to maximum unwanted emission levels for the band 1559-1610 MHz that are stated in the Annexes to Recommendation ITU-R M. 1343. The maximum unwanted emission levels for the band 1559-1610 MHz stated in Recommendation ITU-R M. 1343 have been developed pursuant to a specific interference scenario, and are not intended to be applied to any service other than MSS MESs operating in the 1-3 GHz range without further study.*